

Appl. No. 10/706,880
Response dated May 8, 2006
Reply to Office Action of February 8, 2006

REMARKS/ARGUMENTS

Applicant acknowledges receipt of the Office Action dated February 8, 2006. A total of 28 claims (Claims 1-28) are pending and are currently under examination of which Claim 1 and 16 are independent claims. The Office Action is summarized as follows:

- Claims 1, 2, 5-11, 16, 17, 19-22 and 27-28 were rejected under 35 U.S.C. § 102(e) as being anticipated over U.S. Patent No. 6,447,745 (hereinafter *Feeley*);
- Claims 1-15 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 3,956,188 (hereinafter *Hindin*) in view of U.S. Patent No. 6,221,280 (hereinafter *Anumakonda*) and further in view of U.S. Patent No. 4,331,451 (hereinafter *Isogaya*); and
- Claims 18 and 23-26 were rejected under 35 U.S.C. § 103(a) as being unpatentable over *Feeley* in view of *Anumakonda* and further in view of *Hindin*.

Applicant thanks the Examiner for the care and diligence with which he has examined the pending claims.

I. Amendment to the specification

Applicant has amended paragraphs [0023], [0040]-[0042], [0053], [0059] and line 10 on Page 23 of the specification in order to correct typographical errors, where the paragraph numbers are as originally submitted on the filing date of this application. Applicant submits that no new matter was added by way of amendment to these sections of the specification, and respectfully requests that these amendments be entered.

II. Status of the Claims

By this reply, Claims 1 and 16 are currently amended; Claims 5, 14, 19 and 24 are now canceled; and Claims 29-32 are new. The amendments to Claims 1 and 16 are discussed below in the following Sections III, IV and V.

A total of 28 claims (Claims 1-4, 6-13, 15-18, 20-23, 25-32) are currently pending, in which:

- Claim 1 is an independent claim from which Claims 2-4, 6-13, 15 and 29-30 depend; and
- Claim 16 is an independent claim from which Claims 17, 18, 20-23, 25-28 and 31-32 depend.

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III. Rejection under 35 U.S.C. § 102(e) over *Feeley*

Claims 1, 2, 5-11, 16, 17, 19-22 and 27-28 were rejected under 35 U.S.C. § 102(e) as being unpatentable over *Feeley*. Applicant respectfully traverses the Examiner's rejection for at least the reason that the *Feeley* reference fails to teach or suggest all of the elements recited in currently-amended Claims 1 and 16 and the rejected Claims 2 & 5-11 and 17, 19-22 & 27-28 which are dependent claims.

Feeley discloses a process for the partial catalytic oxidation of a hydrocarbon containing feed comprising contacting the feed with an oxygen-containing gas in the presence of a catalyst retained within a reaction zone in a fixed arrangement, wherein the catalyst comprises at least one catalytically active metal selected from the group consisting of silver and Group VIII elements supported on a porous ceramic carrier having a high degree of specifically defined structural uniformity, such as a fixed ceramic foam monolith or particles- See Abstract; Col. 5, lines 39-44 in *Feeley*.

In this Response, Applicant has amended Claim 1 to incorporate the limitation of Claim 14 (now canceled) and has further amended step (a) of Claim 16 to incorporate the limitation of Claim 24 (now canceled) by requiring "a loss in hydrocarbon conversion no greater than about 3% per day". These amendments are supported by the application as filed, such as for example by at least originally filed Claims 14 and 24 and Table 4 on Page 27 of the specification as filed. *Feeley* fails to disclose this required maximum loss in hydrocarbon conversion as recited in currently-amended Claims 1 and 16. As such, for at least the reasons stated above, Applicant submits that *Feeley* does not teach nor suggest each and every limitation of currently-amended Claims 1 and 16 as required for anticipation -see MPEP 2131:

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987)"

Thus, Applicant believes that independent currently amended Claims 1 and 16 are patentable over *Feeley* and respectfully requests the Examiner to withdraw such rejection.

IV. Rejection under 35 U.S.C. § 103(a) over *Hindin* in view of *Anumakonda* and *Isogaya*

Claims 1-15 were rejected as being obvious over *Hindin* in view of *Anumakonda* and

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Isogaya. Applicant respectfully traverses the Examiner's rejection, and submit that the Examiner has failed to make a *prima facie* case of obviousness in rejecting such claims in that the combination of *Hindin* with *Anumakonda* and *Isogaya* fails to teach or suggest each and every element recited in the rejected claims; and that there is no suggestion nor motivation to combine such references to arrive to the present claimed invention of Claims 1-13 & 15 (Claim 14 was canceled by Applicant in this response as its limitation was incorporated into Claim 1), as is required by MPEP section 2143 for the basic requirements of a *prima facie* case of obviousness.

"...To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974)...". In MPEP 2143.03

Hindin teaches catalyst compositions having good high temperature stability which are particularly useful for selected high temperature reactions as well as their methods of preparation and use. *Hindin* requires that the composition comprises a platinum group metal deposited on a catalytic slip or composite which contains a mixture of alumina, a rare earth metal oxide, and a metallic oxide wherein the metal is IVB (such as Ti, Zr, Hf), selected VIB metals (such as Cr, W), and mixtures thereof, in which the slips or carrier composition is calcined at a temperature of at least 850°C before deposition of platinum group metal and characterized by having a surface area of at least 20 m²/g after calcination at a temperature of 1200 °C for two hours. See Abstract of *Hindin*. In other words, the Pt group metal is exposed to a lower calcination temperature than that of the other two metals (IVB and VIB) after being deposited on the slip and carrier. *Hindin* further discloses that "it is essential that the calcination is conducted before the addition of a platinum group metal component to prevent loss of such component by occlusion." – see Col. 4 lines 28-32. The disclosed methods of use include the high temperature oxidation of carbonaceous fuels, particularly a catalytically-supported thermal combustion of carbonaceous fuels (which include a hydrocarbon source) with oxygen such as in air which results in the formation of carbon dioxide and water. *Hindin*'s catalysts are disclosed as being particularly "useful in promoting the oxidation of hydrocarbons, oxygen-containing organic components, for example, aldehydes, organic acids, and other intermediate products of combustion, such as carbon monoxide, and the like. These materials are frequently present in exhaust gases from the combustion of carbonaceous fuels, and thus the catalysts of the present invention are particularly useful in promoting the oxidation of such materials thereby

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purifying the exhaust gases"- See *Hindin* Col 17 lines 56-63.

However, *Hindin*, as a whole, fails to teach or suggest that the process of high temperature oxidation of carbonaceous fuels exhibits a loss in hydrocarbon conversion of less than 3% per day as recited in Claim 1 and of less than 1% per day as recited in Claim 15. Moreover, since *Hindin* teaches that, in particular, these catalyst compositions are useful in promoting the oxidation of CO, it is inferred that these catalysts would be not be very selective towards CO formation. *Hindin* fails to teach the level of conversion and selectivities obtained at 2 atmospheres or more as recited in Claims 12 and 13. *Hindin* further fails to teach the metal surface area of greater than 0.35 m²/g, as recited in Claim 4.

Applicant submits that *Anumakonda* and *Isogoya* fail to provide the missing limitations of *Hindin* to arrive to the present claimed invention of Claims 1-4, 6-13 & 15.

Anumakonda discloses a method of processing sulfur-containing heavy hydrocarbon fuels (with a sulfur content of at least 50 ppm) with an oxidizer in the substantial absence of steam through catalytic partial oxidation -see *Abstract* (wherein a "heavy hydrocarbon fuel" is defined as a liquid mixture of hydrocarbon molecules having at least 6 carbon atoms - See Col 7 lines 61-64). The processing comprises the steps of vaporizing a heavy hydrocarbon fuel and bringing the vaporized fuel and oxidizer mixture in contact with a noble metal catalyst supported on an open channel structure. The feed, containing only the vaporized fuel and oxygen in the oxidizer mixture, is subsequently routed through a reactor containing a noble metal catalyst (typically Rh/Alumina) at contact times of not more than about 500 milliseconds and a LHSV of not less than about 0.5 hr⁻¹. The feed is partially oxidized by a catalytic reaction occurring at a temperature of no less than about 1050°C, with the catalytic partial oxidation process producing essentially complete conversion of hydrocarbons present in the feed to hydrogen and carbon monoxide. The sulfur compounds in the feed are predominantly converted into hydrogen sulfide. The product gas consisting mainly of carbon monoxide and hydrogen can then be recovered or, alternatively, directed to a solid oxide fuel cell system. There is no mention of an operating pressure range in *Anumakonda*. However, it can be inferred from the experimental setup described in Example 1 (i.e., use of a quartz tube without the protection of a pressure-rated material-see Col 12 lines 24-26), from the disclosed end use of the generated synthesis gas product (i.e., fuel for a solid oxide fuel cell- see *Anumakonda Abstract*; Col 8 lines 40-44) and from the mere omission of disclosure on an operating pressure, that *Anumakonda*

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operates the catalytic partial oxidation process at about atmospheric pressure. Thus, the experimental results in *Anumakonda* for CO and H₂ yields can be viewed as representative of process performance at about atmospheric pressure. Thus, *Anumakonda*, as a whole, fails to teach or suggest that the catalytic partial oxidation process of C₆₊ hydrocarbons exhibits a loss in hydrocarbon conversion of less than 3% per day as recited in Claim 1 and of less than 1% per day as recited in Claim 15. Moreover, since *Anumakonda* fails to teach the level of conversion and selectivities obtained at 2 atmospheres or more as recited in Claims 12 and 13. *Anumakonda* further fails to teach the metal surface area of greater than 0.35 m²/g, as recited in Claim 4.

Moreover, contrary to what the Examiner stated on Page 5 lines 3-4 of the Office Action dated February 8, 2006, the catalysts of *Hindin* and *Anumakonda* differ in terms of catalytic compositions and properties. *Anumakonda* uses a noble metal catalyst supported on alumina, while *Hindin*'s catalyst requires, in addition to a platinum-group metal and alumina, a metal oxide where the metal is a group IVB metal or a selected group VIB metal. *Hindin*'s catalyst is effective for the combustion of carbonaceous fuel to form CO₂ and H₂O, and most interestingly *Hindin*'s catalyst is disclosed as being effective in oxidation of CO (see in *Hindin*, very low CO content in combustion effluent in Table II and Col. 17 lines 53-63), while *Anumakonda*'s catalyst is effective in producing CO and H₂. Thus, although it is generally impossible to foretell the performance of a known catalyst composition in a different process having different operating conditions due to the general unpredictability in the chemical arts, if, *arguendo*, one were to assume that *Hindin*'s catalyst were to be used in *Anumakonda*'s process to form synthesis gas, it is debatable whether this catalytic process would achieve acceptable CO selectivity as required by Claims 12 and 13 since *Hindin*'s catalyst is effective in oxidizing CO, and thus decreasing the CO selectivity. Moreover, *Anumakonda* only teaches such process for C₆₊ hydrocarbons; there is no indication from *Anumakonda* that such process would also be effective for producing synthesis gas from catalytic partial oxidation of hydrocarbons of 4 carbons or less as is now required in Claim 1 (and supported by the application as filed, for example by paragraph [0056] on Page 13 of the specification as filed).

As for the third cited reference in this rejection, *Isogaya* was used by the Examiner for its teaching of operating pressures of 2 atm or more, in a catalytic gasification process. *Isogaya* discloses a catalytic gasification process of heavy oil of a specific gravity of higher than 0.7 with steam or steam/oxygen-containing gas characterized in that the heavy oil is contacted with chromium

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oxide catalyst or a catalyst comprising a mixture of chromium oxide and one or more of alkaline earth metal oxides, aluminum oxide, zirconium oxide, nickel oxide and cobalt oxide- *see Isogaya's Abstract*. More particularly, the present invention relates to a two-bed gasification process for heavy oil of a specific gravity of higher than 0.7 characterized in that higher hydrocarbons are converted into lower hydrocarbons such as CH_4 , C_2H_4 and C_3H_6 in addition to H_2 , CO , CO_2 and H_2O in the presence of the first catalyst bed in the upper part of the reaction zone and then the cracking and gasification of the hydrocarbons are completed in the second catalyst bed in the lower part of the reaction zone. The first catalyst bed is filled with calcium aluminate, an alkali aluminate or tungsten-containing nickel, while the second catalyst bed is filled with chromium oxide or a chromium oxide-containing catalyst- *see Isogaya Col 6 lines 55-68*. Preferred reaction temperature of $800\text{-}1300^\circ\text{C}$ as below 800°C , carbon deposition affects the continuous operation of the process. Most importantly, *Isogaya* requires steam with a steam to carbon molar ratio of at least 0.3 - *see Isogaya Col 7 lines 41-52*. It is to be noted that the effectiveness of *Isogaya's* process hinges on some cracking ability for reducing the carbon chain length. However, *Isogaya*, as a whole, fails to teach or suggest that the gasification process of C_{6+} hydrocarbons to generate an effluent comprising synthesis gas exhibits a loss in hydrocarbon conversion of less than 3% per day as recited in Claim 1 and of less than 1% per day as recited in Claim 15. Moreover, *Isogaya* fails to teach the level of conversion and selectivities obtained at 2 atmospheres or more as recited in Claims 12 and 13, and further fails to teach the metal surface area of greater than $0.35\text{ m}^2/\text{g}$, as recited in Claim 4.

The Examiner has used *Isogaya* for his teaching of the use of a pressure of 2 atm or more in a gasification process of heavy hydrocarbons *requiring steam* to be used in the process of *Anumakonda requiring substantially no steam* with the catalyst composition of *Hindin* which has different composition and properties than the catalysts used in *Anumakonda's* and *Isogaya's* processes while yet still achieving the high H_2 and CO yields as obtained in *Anumakonda's* process at about atmospheric pressure to arrive to the claimed invention of Claims 1-13 & 15. Applicant submits that one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention. To the contrary, the prior art suggests the opposite effect, and that obtaining such conversions and selectivities at a pressure of 2 atm or more in a partial oxidation process would be unexpected. For example, *Isogaya* in *Col 4 lines 67-68* teaches that the methane decomposition becomes more complete as the pressure is reduced; in other words, as the pressure is

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increased, the methane decomposition becomes less complete, which indicates that a higher pressure tends to reduce at least methane conversion. Indeed, scientific principles strongly suggest that operation of catalytic partial oxidation of any light hydrocarbon(s) such as methane or natural gas at pressures greater than 2 atmospheres poses great challenges, one of the major ones being the unfavorable thermodynamics of the catalytic partial oxidation as the pressure goes up. That is to say, since there is a net increase in the number of moles (in the same volume of gas) across the reaction, an increase in pressure will drive the equilibrium toward the reverse reaction and will result in decline in conversion and selectivities. In addition, as described by *Feeley* in *Col. 10 lines 60-63* (the reference which the Examiner has cited in the previous 102 rejection), as pressure goes up, there are homogenous, non-catalytic reactions that start to compete with the desired reaction and become more prevalent. Such reactions make carbon/coke, heavier hydrocarbons, and lead to the full combustion of methane to carbon dioxide. Thus, at best one having ordinary skill in the art may be led to try *Hindin's* catalyst in the process of *Anumakondabu* but would have no reasonable expectation that it would be successful in a catalytic partial oxidation process with such hydrocarbon conversion maximum loss and/or such selectivities and conversions at 2 atm or more.

Thus, Applicant submits that a *prima facie* case of obviousness was not put forth in such rejection, as the MPEP 2143.01 provides that "there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify or combine reference teachings."; MPEP 2143.02 further provides that "the prior art can be modified or combined to reject claims as *prima facie* obvious as long as there is a reasonable expectation of success. *In re Merck & Co., Inc.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986)" and MPEP 2143.03 further provides that "to establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974)".

Thus, Applicant submits that Claim 1 as currently amended is patentable over the combination of *Hindin* with *Anumakonda* and further with *Isogaya*. Since Claims 2-4, 6-13 & 15 depends directly or indirectly from such patentable claim and carries with them all of the limitations of such claim, Applicant submits that Claims 2-4, 6-13 & 15 are also patentable over such combination of references. Thus, Applicant respectfully requests that the 103 rejection of Claim 1-4, 6-13 & 15 be withdrawn.

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V. Rejection under 35 U.S.C. § 103(a) over *Feeley* in view of *Anumakonda* and *Hindin*

Claims 18 and 23-26 were rejected as being obvious over *Feeley* in view of *Anumakonda* and *Hindin*. Applicant respectfully traverses the Examiner's rejection, and submit that the Examiner has failed to make a *prima facie* case of obviousness in rejecting such claims.

Claim 24 was cancelled in this amendment as its limitation was incorporated into Claim 16. So Applicant will address the rejection on Claims 18, 23 and 25-28. As previously stated in Section III above, *Feeley* fails as a primary reference as it does not disclose implicitly or explicitly all of the elements of Claim 16 from which Claims 18, 23 and 25-28. Furthermore, *Feeley* fails to disclose implicitly or explicitly all of the elements of Claims 18, 23 and 25 as discussed in Section III above which covers the 102 rejection. Moreover, the teachings of *Anumakonda* and *Hindin* as discussed in Section IV above, are also deficient in such teachings. Thus the combination of *Feeley* with *Anumakonda* and *Hindin* fails to teach or suggest each and every element recited in Claims 18, 23 and 25-28, as is required by MPEP section 2143.03. Moreover, the Examiner failed to show a suggestion or motivation to combine such references to arrive to the present claims with a reasonable expectation of success, as is required by MPEP sections 2143.01 and 2143.02.

Thus, Applicant believes that a *prima facie* basis for obviousness has not been established and respectfully requests that the 103 rejection of Claims 18, 23 and 25-26 be withdrawn.

VI. New Claims

Applicant further added Claims 29-32 to add embodiments to which the Applicant is entitled. Applicant submits that the cancellation of a total number of 4 claims in this Response (i.e., Claims 5, 13, 19, 24) is sufficient to cover these 4 new claims.

- New Claim 29 is dependent from Claim 1 and new Claim 31 is dependent from Claim 16. Both of these new claims narrow the modifying agent content in the catalyst by requiring that "the catalyst comprises from 1 to 10 wt % of said at least one modifying agent based on the total catalyst weight". Such new claims are supported by the application as filed, for example by at least paragraph [0025] on Page 6 of the specification as filed. *Feeley* fails to disclose the claimed range in modifying agent content based on the total weight of the catalyst, as recited in these new Claims 29 and 31 (as currently amended). Indeed, *Feeley's* disclosure, as a whole, teaches that the

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carrier should have a specific uniform microarchitectural structure (see Col. 6, lines 46-47) in order to obtain satisfactory selectivity and conversion (see for example Col 9 lines 44-49). *Feeley* seeks to reduce gas phase reactions to the maximum extent, and *Feeley's* premise is that the "[m]ore uniform carrier or substrate microarchitecture can contribute to reduced gas phase chemistry in the catalyst bed as a consequence of more uniformly distributed void volume within the carrier"- see in *Feeley* Col. 11, lines 27-30. Thus, it is clear that the carrier is an integral part of *Feeley's* catalyst and cannot be excluded from the total catalyst composition. In *Feeley's* preferred embodiments, the catalytically active material is first deposited on a (powder) support to form a washcoat (or slip) which is then deposited onto the uniform carrier (see for example Col. 9 lines 59-66; Col. 10 lines 11-13; Sample B on Col 22 lines 22-29). *Feeley further discloses the use of* one type of modifier selected from the group consisting of the oxides of La, Ba and Pr, where the modifier is an agent that stabilizes the support surface area (see Col 10 lines 27-35). In alternate embodiments of *Feeley*, the catalytically active material is directly loaded onto the carrier, that is to say, without a washcoat in which the catalytically active material is supported in or dispersed in the washcoat (see Col. 9 lines 54-59; Sample A on Col 22 lines 13-21). However, in this non-washcoated catalysts, *Feeley* fails to teach or suggest that a modifier be used to stabilize the carrier. Thus, the teaching of *Feeley* concerning the use of La, Ba and/or Pr pertains to the stabilization of support in the washcoated catalyst embodiments. Furthermore, *Feeley* discloses the modifier's loadings in the washcoated catalysts based on the weight of the washcoat support, not on the weight of the final catalyst. As a result, the total modifier content of *Feeley's* washcoated catalysts is much less than those disclosed in the washcoat. For instance, Sample B, described at Col. 22, lines 22-30 of *Feeley* is a washcoated catalyst with 5 wt% Rh, 3 wt% La and 5 wt% Ba content in the washcoat at a washcoat loading of 0.33 g/in³, which, *Feeley* states, corresponds to a total rhodium loading of 0.128 wt. % *based on the total weight of the catalyst* (Rh + washcoat + foam). Based on this calculation, one can extrapolate that the total lanthanum and barium loadings in Sample B approximate 0.077 wt. % La and 0.026 wt.% Ba *based on the total weight of the catalyst*. In addition to Sample B, Tables 3 and 4 at col. 23 in *Feeley* list catalyst Samples C, D, F, G, H, E and I with different washcoat loadings varying from 0.23 to 2.16 g/in³ washcoated on the same carrier as Sample B, where the washcoat contains 3 wt. % La, 1 wt.% Ba and optionally 1 wt. % S (for Samples C, D, and F). Since Samples C, D, F, G, H, E and I use the same carrier as Sample B, the same calculation can be made to extrapolate the total La,

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Ba and S contents in the resulting catalyst Samples C, D, F, G, H, E and I. Thus, Samples C, D, F, G, B, H, E and I have a total lanthanum content between 0.054 wt. % (Ex. C) and 0.503 wt. % (Ex. F) *based on the total weight of the catalyst*. Thus, for the washcoated catalysts of *Feeley*, in which the carrier is an integral part and in which the washcoat comprises an alumina support modified by La, Ba and/or Pr, the modifier content is outside of the range recited for the modifying agent as in new Claims 29 and 31 of the present application.

- New Claims 30 is dependent from Claim 7 and new Claim 32 is dependent from Claim 21, both of which narrow the rhodium content in the catalyst by requiring that "the catalyst comprises from 0.5 to 10 wt % of rhodium based on the total catalyst weight". Such new claims are supported by the application as filed, for example by paragraph [0033] on Page 8 of the specification as filed.

Applicant respectfully requests these new claims to be considered. Applicant believes that independent Claim 1 as currently-amended is in allowable form, and since each of the new Claims 29 and 30 ultimately carries all the limitation of Claim 1, new Claims 29 and 30 are *a fortiori* allowable as well. Similarly, Applicant believes that independent Claim 16 as currently-amended is in allowable form, and since each of the new Claims 31 and 32 ultimately carries all the limitation of Claim 1, new Claims 31 and 32 are *a fortiori* allowable as well.

XII. Conclusion

Applicant believes that they have fully responded to the Office Action dated February 8, 2006, and that this amendment places the application in condition for allowance. Applicant believes that no new matter is introduced by way of this amendment and that all pending claims are in condition for allowance. Favorable action at the Examiner's earliest convenience is respectfully solicited.

In the course of the foregoing discussions, Applicant may have at times referred to claim limitations in shorthand fashion, or may have focused on a particular claim element. This discussion should not be interpreted to mean that the other limitations can be ignored or dismissed. The claims must be viewed as a whole, and each limitation of the claims must be considered when determining the patentability of the claims. Moreover, it should be understood that there may be other distinctions between the claims and the prior art which have yet to be raised, but which may be

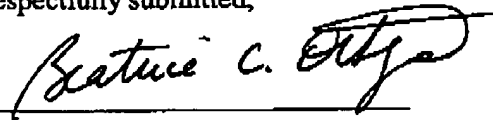
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raised in the future.

Should any fees have been inadvertently omitted, or if any additional fees are required or have been overpaid, please appropriately charge or credit those fees to **Deposit Account Number 16-1575 of ConocoPhillips Company**, Houston, Texas, and consider this a petition for any necessary extension of time.

Should there be any remaining issue which the Examiner believes would possibly be resolved by a conversation, the Examiner is invited to call the undersigned at (281) 293-4751 so that further delay in a Notice of Allowance can be avoided.

Respectfully submitted,



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